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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/748,545	12/29/2003	Mark L. Doczy	P18245	9131

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Michael A. Bernadicou  
BLAKELY, SOKOLOFF, TAYLOR & ZAFMAN LLP  
Seventh Floor  
12400 Wilshire Boulevard  
Los Angeles, CA 90025

EXAMINER

NGUYEN, THANH T

ART UNIT PAPER NUMBER

2813

DATE MAILED: 05/25/2006

Please find below and/or attached an Office communication concerning this application or proceeding.

## Office Action Summary

Application No.

10/748,545

Applicant(s)

DOCZY ET AL.

Examiner

Thanh T. Nguyen

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-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

### Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

### Status

- 1) ☒ Responsive to communication(s) filed on 20 March 2006.
- 2a) ☒ This action is **FINAL**. 2b) ☐ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

### Disposition of Claims

- 4) ☒ Claim(s) 1-20 is/are pending in the application.
- 4a) Of the above claim(s) 4-6, 12-14 and 16-20 is/are withdrawn from consideration.
- 5) ☒ Claim(s) 11 and 15 is/are allowed.
- 6) ☒ Claim(s) 1-3 and 7-9 is/are rejected.
- 7) ☒ Claim(s) 10 is/are objected to.
- 8) ☐ Claim(s) \_\_\_\_\_ are subject to restriction and/or election requirement.

### Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on \_\_\_\_\_ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.
- Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
- Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

### Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some \* c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. \_\_\_\_\_.
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
- \* See the attached detailed Office action for a list of the certified copies not received.

### Attachment(s)

- 1) ☒ Notice of References Cited (PTO-892)
- 2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
- 3) ☐ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08)  
Paper No(s)/Mail Date \_\_\_\_\_
- 4) ☐ Interview Summary (PTO-413)  
Paper No(s)/Mail Date \_\_\_\_\_
- 5) ☐ Notice of Informal Patent Application (PTO-152)
- 6) ☐ Other: \_\_\_\_\_

## **DETAILED ACTION**

### ***Response to Arguments***

Applicant's arguments with respect to claims 1-3, 7-11, 15 have been considered but are moot in view of the new ground(s) of rejection.

### ***Claim Rejections - 35 USC § 102***

The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

(e) the invention was described in (1) an application for patent, published under section 122(b), by another filed in the United States before the invention by the applicant for patent or (2) a patent granted on an application for patent by another filed in the United States before the invention by the applicant for patent, except that an international application filed under the treaty defined in section 351(a) shall have the effects for purposes of this subsection of an application filed in the United States only if the international application designated the United States and was published under Article 21(2) of such treaty in the English language.

Claims 1-3, 7 are rejected under 35 U.S.C. 102(b) as being anticipated by Misra et al. (U.S. Patent No. 5,960,270).

Referring to figures 10-22, Misra et al. teaches a method for making a semiconductor device comprising:

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forming a patterned sacrificial gate electrode layer (108) that is covered by a hard mask (110), that is covered an etch stop layer (120), wherein the sacrificial gate electrode layer (108) is not covered by a silicide layer (116, see figure 13);

forming first and second spacers (114) on opposite sides of the patterned sacrificial gate electrode layer (108, see figure 13),

forming silicide layers (116) proximate to the first and second spacers (114), wherein etch stop layer inhibits the formation of a silicide layer on any portion of the sacrificial gate electrode layer (see figure 13, since no silicide layer formed on the gate electrode, it is inherent that the etch stop layer inhibit the formation of the silicide),

removing the patterned sacrificial gate electrode layer (108, see figure 16) to generate a trench that is positioned between the first and second spacers (see figure 16), and

filling at least pad of the trench with a metal layer (128, see figure 16).

Regarding to claim 2, the patterned sacrificial electrode layer (108) is formed on a patterned first dielectric layer (106) that is formed on a substrate (102), and further comprising forming source and drain regions (118) that comprise a silicide (116) next to the first and second spacers (114) (see figure 13), and forming a second dielectric layer (122) on the etch stop layer (120) and the substrate (102).

Regarding to claim 3, wherein the patterned first dielectric layer comprises silicon dioxide (106), and further comprising removing the second dielectric layer (122) from the etch stop layer (110), removing the etch stop layer from the hard mask (120); and removing the hard mask from the patterned sacrificial gate electrode layer (108) prior to removing the patterned sacrificial gate electrode layer (see figures 14-15).

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Regarding to claim 7, the metal layer comprises a material that is selected from the group consisting of hafnium, zirconium, titanium, tantalum, aluminum, a metal carbide, ruthenium, palladium, platinum, cobalt, nickel, and a conductive metal oxide (see col. 10, lines 17-23).

***Claim Rejections - 35 USC § 103***

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

Claims 8-9 are rejected under 35 U.S.C. 103(a) as being unpatentable over Misra et al. (U.S. Patent No. 5,960,270) as applied to claims 1-3, 7 above in view Barns (U.S. Patent No. 6,743,683).

Misra et al. teaches a method of forming a gate transistor. However, Misra et al. does not teach forming the metal layer layer comprises a material that is selected from the group consisting of hafnium, zirconium, titanium, tantalum, aluminum, and a metal carbide, ruthenium, palladium, platinum, cobalt, nickel, and a conductive metal oxide and has a workfunction that is between about 3.9 eV and about 4.2 eV, or between about 4.9 eV and about 5.2 eV.

Nevertheless, the process is known in the semiconductor as evidenced by Barns. Barns teaches regarding to claim 8, the metal layer comprises a material that is selected from the group consisting of hafnium, zirconium, titanium, tantalum, aluminum, and a metal carbide, (see col. 4, lines 30-33) and has a workfunction that is between about 3.9 eV and about 4.2 eV. Noted that aluminum or titanium layer has the work function of between about 3.9 eV and about 4.2 eV.

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Regarding to claim 9, the metal layer comprises a material that is selected from the group consisting of ruthenium, palladium, platinum, cobalt, nickel, and a conductive metal oxide (see col. 4, lines 30-33), and has a workfunction that is between about 4.9 eV and about 5.2 eV.

Noted that ruthenium layer has the work function of between about 4.9 eV and about 5.2 eV.

Noted that it is inherent that each conductive film has its own work function. Hence, the same material would provide the same workfunction. See In re Best, 195 USPQ 428 (CCPA 1977) and In re Fitzgerald, 205 USPQ 594 (CCPA 1980).

Therefore, it would have been obvious to a person of ordinary skill in the requisite art at the time of the invention was made would form the metal layer comprises a material that is selected from the group consisting of hafnium, zirconium, titanium, tantalum, aluminum, and a metal carbide, ruthenium, palladium, platinum, cobalt, nickel, and a conductive metal oxide and has a workfunction that is between about 3.9 eV and about 4.2 eV, or between about 4.9 eV and about 5.2 eV in process of Misra et al. as taught by Barns because forming the metal layer by using hafnium, zirconium, titanium, tantalum, aluminum, and a metal carbide, ruthenium, palladium, platinum, cobalt, nickel, and a conductive metal oxide would provide a highly conductive gate electrode

#### ***Allowable Subject Matter***

Claim 10 is objected to as being dependent upon a rejected base claim, but would be allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims.

Claims 11, 15 are allowed because none of the prior art alone or in combination teaches or suggests the particular subset of the process steps in forming the first and second spacers comprise silicon nitride and are formed on opposite sides of the patterned sacrificial gate electrode layer by depositing a layer of silicon nitride on the etch stop layer, the substrate, and on the opposite sides of the patterned sacrificial gate electrode layer, then removing the layer of silicon nitride from the etch stop layer and from part of the substrate.

### ***Conclusion***

Applicant's amendment necessitated the new ground(s) of rejection presented in this Office action. Accordingly, **THIS ACTION IS MADE FINAL**. See MPEP § 706.07(a). Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire **THREE MONTHS** from the mailing date of this action. In the event a first reply is filed within **TWO MONTHS** of the mailing date of this final action and the advisory action is not mailed until after the end of the **THREE-MONTH** shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than **SIX MONTHS** from the date of this final action.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Thanh Nguyen whose telephone number is (571) 272-1695, or by

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Email via address Thanh.Nguyen@uspto.gov. The examiner can normally be reached on Monday-Thursday from 6:00AM to 3:30PM.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Carl Whitehead, can be reached on (571) 272-1702. The fax phone number for this Group is (703) 872-9306.

Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the Group receptionist whose telephone number is (703) 308-0956 (See **MPEP 203.08**).

A handwritten signature in black ink, appearing to read 'Thanh', with a long horizontal stroke extending to the left.

Thanh Nguyen  
Patent Examiner  
Patent Examining Group 2800

TTN